

Maryland Space Grant Consortium
Lead Institution: Johns Hopkins University
Director: Dr. Richard Conn Henry
Telephone Number: 410-516-7350
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PROGRAM DESCRIPTION

The National Space Grant College and Fellowship Program consists of 52 state-based, university-led Space Grant Consortia in each of the 50 states plus the District of Columbia and the Commonwealth of Puerto Rico. Annually, each consortium receives funds to develop and implement student fellowships and scholarships programs; interdisciplinary space-related research infrastructure, education, and public service programs; and cooperative initiatives with industry, research laboratories, and state, local, and other governments. Space Grant operates at the intersection of NASA's interest as implemented by alignment with the Mission Directorates and the state's interests. Although it is primarily a higher education program, Space Grant programs encompass the entire length of the education pipeline, including elementary/secondary and informal education. The Maryland Space Grant Consortium is a Designated Consortium funded at a level of \$575,000 for fiscal year 2012.

PROGRAM GOALS

FELLOWSHIPS AND SCHOLARSHIPS

GOAL I: To offer financial support to those higher education students enrolled in Maryland Institutions that wish to pursue a career in space-related STEM fields. Objective #1: The MDSG Scholarship Committee will continue to recruit qualified students for scholarships among the seven degree-granting institutions in the consortium, *viz.*, JHU, MSU, UMCP, TU, UMES, UMBC, Capitol College and HCC. Objective #2: The Scholarship Committee will continue to emphasize the recruitment of students from groups underrepresented in STEM disciplines. Objective #3: Continue to use the MDSGC Observatory, which is located on the roof of the Bloomberg Center for Physics & Astronomy on the Homewood campus of JHU, for student training and public outreach.

HIGHER EDUCATION

GOAL II: Provide Higher education students with opportunities to enhance their education in STEM areas and to promote their entry into aerospace related disciplines. Programs that provide relevant hands-on experience will be given high priority. Objective #1: Continue to support and enhance the MDSGC Balloon Payload Program (BPP) that provides students with access to near-space. Objective #2: Provide strong support to internships programs for undergraduate and graduate students on an ongoing basis, either through direct funding or through partnerships with organizations such as

GSFC. Objective #3: Support a portfolio of programs that recruits students to STEM related studies and retains their interest to the point that it eventually carries over into employment in STEM careers in general, and especially careers needed by NASA and the aerospace community. Objective #4: Continue to develop MDSGC capabilities and procedures to conduct longitudinal tracking of students who have received significant support from MDSGC, in order to determine the efficacy of our programs.

RESEARCH INFRASTRUCTURE

GOAL III: Support projects that provide opportunities for students to participate in aerospace-related research. Objective #1: Provide funding for programs that directly support students in gaining aerospace-related research experience. Objective #2: Ensure that research opportunities are made available to a diverse group of highly qualified students.

PRE-COLLEGE

GOAL IV: Support programs that provide substantive training to Maryland teachers that allow them to incorporate NASA-related content into effective teaching strategies. Objective #1: Facilitate the delivery of training that develops teacher's skills in the use of, and access to, earth and space science related data and discoveries, which will then inspire students to pursue careers in science, technology, engineering, and mathematics (STEM). Objective #2: Provide additional opportunities beyond the current earth and space science certification program for providing current content knowledge to in-service and pre-service teachers. Objective #3: Support programs that provide for hands-on, aerospace-related activities for middle school students.

INFORMAL SCIENCE

GOAL V: Increase the content knowledge of Maryland educators through training in informal science venues.

PROGRAM/PROJECT BENEFIT TO OUTCOME (1,2, & 3)

Provide concise, meaningful highlights or anecdotes (no more than three) that are directly related to work completed in 2012, highlighting student and/or project accomplishments. Specify alignment to an Outcome.

Outcome 1: A student who has been an active participant in the Balloon Payload Program throughout her undergraduate career, and has been supported as the student program manager for the BPP during her tenure as a graduate student, is completing her master's degree in aerospace engineering this June. She participated in several NASA HASP flights, with support from MDSGC. She has accepted employment at JPL in the Advanced Computer Technologies group, working on avionics, and one of her first projects will be the InSight Mars lander.

Outcome 1: MDSGC funded two students to participate in the RockOn Program in the summer of 2012. One of these students, a junior physics major at Johns Hopkins University became exceptionally excited with the program. She has created a team to build an advanced scientific experiment as a payload for the RockSat X program this

summer. She wrote a successful proposal for support from MDSGC. She has pulled together a team of science and engineering students to develop the payload, drawing students from Johns Hopkins and MDSGC affiliate, University of Maryland College Park. She has also secured lab space and a mentor at the Johns Hopkins University Applied Physics Laboratory as well as at the JHU Department of Physics & Astronomy.

Outcome 1: A former student who was supported for summer internships in 2005 and 2006 had this to say in her longitudinal tracking report: “My experiences within NASA through 3 Centers and JPL over the past 9 years have greatly contributed to my preparation for my career with the Agency.” She currently works as a Research Aerospace Engineer at NASA Langley Research Center.

PROGRAM ACCOMPLISHMENTS

Refer directly to the consortium goals and SMART objectives in your 2010 base proposal when describing your accomplishments.

Outcome 1: *Contribute to the development of the STEM workforce in disciplines needed to achieve NASA’s strategic goals:* (Discussion of achievements and progress related to your Fellowship/Scholarship, Higher Education and Research Infrastructure programs). *(Employ and Educate)*

Explicitly addressing Objective #1 of Goal I, the MDSGC Scholarship Committee awarded scholarships to students with majors in STEM fields that relate to aerospace workforce needs. These scholarships were awarded at affiliate institutions of MDSGC. In all, 34 students were awarded scholarships in this program. This represents a reduction of 21% for the number of students supported in the previous year, which reflects the 26% reduction in Fellowship/Scholarship funds. Of the 34 students, 11 (32%) were female and 14 (41%) were underrepresented minorities. Additional fellowship/scholarship awards were made through competitive programs, including summer internships. A total of 51 students received fellowship and scholarship funds. Of these 51 students, 17 (33%) were female and 24 (47%) were underrepresented minorities.

Supporting Goal II, Objective 2, the Student Exchange Program was again a success this past summer. Two students each from the University of Maryland Eastern Shore, University of Maryland College Park, and Morgan State University participated. They each worked with a mentor on a NASA-related engineering research project. The applications of these research projects spanned a wide range of topics, including energy management systems, software defined radio, visibility for helicopters, lunar habitat, remote sensing for precision agriculture, and robot boats for water quality monitoring. A student research seminar was held during the summer for the students to present their work, and one student gave a presentation and demonstration of the boat monitoring platform at the Mid-Atlantic Space Grant meeting.

Outcome 2: *Attract and retain students in STEM disciplines through a progression of educational opportunities for students, teachers, and faculty:* (Discussion of

achievements primarily focused on your Higher Education programs not discussed in Outcome 1 and your Precollege programs). (*Educate and Engage*)

MDSGC supported the Howard County Schools in successfully securing a berth for their student experiment aboard the International Space Station. This effort was facilitated by our new affiliate, NCESEE. The school system conducted a competition among their middle schools to select the best student-designed experiment, and the winning team was able to compete successively for the berth on the ISS.

In a repeat program, Hagerstown Community College was successful in obtaining funding through the MDSGC competitive process for its *Girls Exploring Engineering* program. During the summer fourteen middle school girls participated for a week of intensive hands-on activities and discussions with four practicing female engineers. The students were also excited by the visit to the program by Senator Barbara Mikulski. 100% of the participants indicated that: they would recommend the program to their friends, had increased their interest in engineering, and increased their confidence in doing science.

The teacher training program at JHU is discussed elsewhere in this report. An additional teacher training program was supported in the summer of 2012 at the US Naval Academy. In this program 30 middle and high school in-service teachers experienced six days of professional development in NASA-related STEM topics. 80% of the participants were female and 30% were from underrepresented minorities.

Capitol College conducted a VelcroSAT program in which 21 students participated. In this program they studied the feasibility of using one or more picosatellites to tackle the orbital debris problem.

Capitol College also conducted a series of two-hour workshops for undergraduate students from Capitol College and Prince Georges Community College. The project was done in collaboration with the JHU Applied Physics Laboratory and Northrup Grumman. This series focused on STEM majors and provided substantial amounts of career information relating to working in the aerospace community. There were 95 students who participated, with 32% of them female, and 72% from underrepresented minorities.

Outcome 3: *Build strategic partnerships and linkages between STEM formal and informal education providers that promote STEM literacy and awareness of NASA's mission:* (Achievements and progress of Informal Education programs). (*Engage and Inspire*)

In 2012 MDSGC did not receive any fund-worthy proposals for collaboration with an informal science institution. MDSGC has a long history of partnering with the Maryland Science Center, one of the leading science centers in the country. The Assistant Director has been reappointed to the Scientific Advisory Council for the MSC, and they will be discussing new ways to support the programs of the two entities. The current level of funding will likely limit us to activities such as proposal support, advertising each other's

programs, and providing personnel to assist with specific programs, on a no-exchange-of-fee basis.

PROGRAM CONTRIBUTIONS TO NASA EDUCATION PERFORMANCE MEASURES

- **Student Data and Longitudinal Tracking:** Total awards = 51; Fellowship/Scholarship = 50, Higher Education/Research Infrastructure = 1; 24 of the total award represent underrepresented minority F/S funding (48%). During the FY12 program year 9 students are pursuing advanced degrees in STEM disciplines, 4 accepted STEM positions at NASA contractors, 7 accepted STEM positions in industry, 4 accepted STEM positions in academia, and 4 went on to positions in non-STEM disciplines. The remaining students have not yet received the degree that they were pursuing while they received their Space Grant award.
- Percentage of students whom have taken their next step and have been successfully tracked through their next step vs. last year of SG support.
 - 86% for 2006
 - 82% for 2007
 - 100% for 2008
 - 92% for 2009
 - 100% for 2010
 - 100% for 2011
 - n/a for 2012 – all participants still enrolled
 - 91% for 2006-2012
- 88% of students significantly supported by MDSGC went on to next steps in STEM disciplines
- **Minority-Serving Institution Collaborations:** Summarize interactions. Reference the names of projects with MSI collaborations.

Two of the nine institutions of higher learning that are affiliates of MDSGC, Morgan State University (MSU) and University of Maryland Eastern Shore (UMES), are HBCUs. As any affiliate, they are expected to, and do, participate in MDSGC activities and programs. They each provide a representative to the Program Committee, which advises on policy and program direction, reviews proposals for funding, develops new proposals for funding, and interacts with other institutions to broaden the MDSGC network. UMES has received numerous Research Infrastructure grants from MDSGC and serves our “anchor” for activities on the Maryland Eastern Shore (where they work regularly with Wallops Flight Facility). MSU is one of the main participants in our Balloon Payload Program, where it is a regular part of their engineering curriculum. MSU also has ongoing research projects funded by MDSGC, where MSU students work with engineers at GSFC on systems engineering projects. In addition, both schools have representatives on the Scholarship Committee who recruit, select, and monitor students at their respective institutions. Each also provides a member of the Oversight Committee, which advises

MDSGC about its overall performance and strategy. Both MSU and UMES participate in our Summer Exchange Program, where (typically two) students from each campus are sent to one of the other campuses for a summer internship in a NASA-related research project. The third participant in the exchange is University of Maryland College Park, which sends one student each to UMES and MSU. Each year, there is a research seminar where these students present their work, and this year it was hosted by MSU. Note that both universities were partners in proposals to the Space Grant Innovative Pilot in STEM Education that were sponsored by MDSGC, with MSU being the lead institution for one of them. UMES has been very active in presenting these results at national conferences and increasing the exposure of Space Grant to a broader audience.

- **NASA Education Priorities:** *Accomplishments related to the “Current Areas of Emphasis” stated in the 2010 Space Grant solicitation. Report on areas that apply to work proposed in your proposal and budget.*

- Authentic, hands-on student experiences in science and engineering disciplines – the incorporation of active participation by students in hands-on learning or practice with experiences rooted in NASA-related, STEM-focused questions and issues; the incorporation of real-life problem-solving and needs as the context for activities.

This is an essential element of all of our student-focused programs and projects. The robotic water quality monitoring program cited elsewhere in this document used the majority of its funds to support a student working on the sensor platform.

The Maryland Space Grant Consortium Observatory is used to train students from MDSGC affiliate institutions in using the telescope. Nine students have been trained since the last report, as well as a new graduate student who serves as the Observatory Technician.

The Balloon Payload Program is completely focused on students designing, fabricating and launching their experiments. The first introduction for student at the University of Maryland College Park and Morgan State University is through the program’s regular inclusion in their engineering course curriculum. As students progress they work on more advanced payloads and NASA HASP experiments.

RockOn participation has led to two teams working on their own science experiments for RockSat C and RockSat X launches. This is described in more detail elsewhere in this document.

Research Infrastructure projects are not a large part of MDSGC’s portfolio, by design. The only ones that we do fund are to largely support students doing hands-on NASA-related research.

Summer internships are also a significant part of our contribution to this type of program. During the summer of 2012 we supported 8 students for internships at NASA Centers. In addition, we supported two of these students for ongoing, part-time internships during the school year. We also supported one student to work at the Chandra X-Ray Observatory, as part of our support for the Science Mission Directorate/Space Grant Internship

Program, that MDSGC coordinates for the National Council of Space Grant Directors (Assistant Director Teays is Co-Chair of the Working Group that organized this program.) Finally, our Summer Exchange Program, which is described elsewhere in this document, placed six students to work on research projects at affiliate college campuses.

- Diversity of institutions, faculty, and student participants (gender, underrepresented, underserved).

Two of the nine institutions of higher learning (22%) that are affiliates of MDSGC are HBCUs. and several others (UMBC, CC, UMCP) have significant percentages of students from underrepresented populations. Our practice is to have affiliate members who are very actively engaged in the work of MDSGC, participating in its programs, and receiving student scholarship funds, as is the case for University of Maryland Eastern Shore and Morgan State University. All of these institutions are active and sending proposals regularly, which have enjoyed reasonable levels of success. Our membership also includes a community college and both small and large institutions, both public and private, and a US military academy. In addition, we have two of the premiere space science research facilities in the country as active members, *viz.*, Space Telescope Science Institute and the JHU Applied Physics Laboratory. Finally, our newest member is an organization that has fostered some of the key NASA-related education programs in Maryland and nation-wide.

Recruiting of students for scholarships strongly encourages women and underrepresented students for these positions. We make use of such channels as the Center for Minorities in Science and Engineering at UMCP to be sure that we reach a broad spectrum of capable students. Two of the MDSGC staff (out of four) are female and one is Native American.

- Engage middle school teachers in hands-on curriculum enhancement capabilities through exposure to NASA scientific and technical expertise. Capabilities for teachers to provide authentic, hands-on middle school student experiences in science and engineering disciplines (see above).
- Community Colleges – develop new relationships as well as sustain and strengthen existing institutional relationships with community colleges.

One member, Hagerstown Community College (HCC) is a community college. In addition to participating in activities that all affiliates do, HCC serves as the anchor for our activities in the western Maryland panhandle. We are currently discussing a new bridge program for students at HCC, in which a student who has identified their major and what college they wish to transfer to for their final undergraduate work to have a summer internship in that department at that target college.

- Environmental Science and Global Climate Change – research and activities to better understand Earth's environments.

Two of our projects that were funded through our competitive proposal process were related to this subject. An ongoing program of using remote sensing data for precision agriculture studies emphasized nitrogen and water use efficiency this year. This program works closely with scientists at Wallops Flight Facility. One of our Exchange Program students worked with a mentor and her team at UMES to further develop a robotic boat as a platform for collecting water quality samples. This year they worked in the Assateague shore environs.

IMPROVEMENTS MADE IN THE PAST YEAR

Succinctly describe improvements and/or adjustments made last year that demonstrate significant change(s) within the consortium. The improvements and/or adjustments that brought about change may have been in management, resource allocation, project design, project evaluation, etc.

MDSGC added a new member this year, the National Center for Earth and Space Science Education. NCESS is a virtual institute, with its main administrative functions housed in Maryland. They had been instrumental in arranging for Maryland school students to place experiments on the Shuttle, and now the International Space Station. They have submitted a number of proposals, several of which have been accepted, and they executed them well and reported on them in detail. They also have broad connections to many education institutions and programs around the country. They have become a very active member.

MDSGC and the College of Education at Johns Hopkins University have conducted a training program for in-service teachers many years. In this program, teachers take a series of courses that lead to a certificate in earth and space science teaching. In the most recent cohort we concentrated our recruiting efforts in the City and County of Baltimore. The current cohort will be the final one that MDSGC will support. The College of Education has deemed this a sufficiently worthy program that they are planning to continue it with their own funding.

Reduced funding has necessitated changes in the staffing levels of MDSGC. The Director will be reducing the percentage of his time paid by MDSGC by 20%, as will the Assistant Director.

PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION

Johns Hopkins University – Lead Institution
Capitol College
Hagerstown Community College
Johns Hopkins University Applied Physics Laboratory
Morgan State University

National Center for Earth & Space Science Education
Space Telescope Science Institute
Towson University
United States Naval Academy
University of Maryland Baltimore County
University of Maryland College Park
University of Maryland Eastern Shore

Johns Hopkins University is the Lead Institution, and both the Director, Assistant Director, and MDSGC staff are employees of JHU. The main decision making body for MDSGC is the Program Committee, which meets 4-5 times per year, and has a representative from each of the affiliates.

It is a requirement for continued membership that an affiliate be actively involved with MDSGC and its programs. Each institution has a member on the Program Committee, which reviews proposals for funding and advises the program. The Program Committee meets 4-5 times per year. Each institution provides a senior staff member who serves on the Oversight Committee, which meets annually with the Director to review the program. Scholarships are provided to students at JHU, HCC, MSU, TU, UMBC, UMCP, CC and UMES, all of which have one or more members on the Scholarship Committee who are actively engaged in recruiting and selecting students.

The National Space Grant Office requires two annual reports, this Annual Performance Data Report (APD) and the Office of Education Performance Measurement System (OEPM) report. The former is primarily narrative and the latter data intensive. Because the reporting timeline cycles are different, data in the two reports may not necessarily agree at the time of report submission. OEPM data are used for official reporting.